TEAM STRUCTURE EVALUATION OF HAZARDOUS MATERIALS EMERGENCY RESPONSE TEAMS IN THE MIDWEST

STRATEGIC MANAGEMENT OF CHANGE

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ABSTRACT

A formal plan to evaluate the success of hazardous materials emergency response teams did not exist at the Iowa City Fire Department. Problems with its own level 2 response team caused this agency to question whether team structure and makeup changes might enhance program success.

The purpose of the research was to evaluate structure and configuration components of level 2 response teams in the Midwest, with results to yield agency recommendations. The study used evaluative research methodology to answer the following:

1. In evaluating success criteria for hazardous materials emergency response teams in the Midwest, what impact do the following factors have on success?
    a. geographical response boundaries.
    b. population served.
    c. career, volunteer, or combination team structure.
    d. the number of technicians.
    e. member orientation (fire service, law enforcement, private sector).
    single organization vs. multiple organization teams.
    g. how long the team has been in existence.
    h. who manages/coordinates the team.
2. For Midwest hazardous materials emergency response teams that provide service outside their normal jurisdiction, how is legal authority obtained?
3. How are Midwest hazardous materials emergency response teams funded?

A literature search was conducted and a 40 question survey was developed. The purpose of the survey was to delineate eight components of team structure and to numerically score respondents in seven success criteria. The survey was mailed to 150 level 2 haz-mat teams in nine Midwestern states. One hundred and fourteen responded, providing a confidence level of at least 95%. Results were arranged for analysis using interval scales. An arithmetic mean was established to allow variance and standard deviation calculations.

The data revealed favorable success scores for certain team structure components. Each of the following were considered favorable on an interval scale analysis using the seven success criteria: being industry based, serving a large population, having career members, having more than 76 technicians, having all members from one organization, and having a team that has been in existence for 11 years and over.

From the research, agency recommendations were formulated. A 1.04 standard deviation in the local agency program evaluation and enduring problems with leadership, cost sharing, and volunteer retention led to the following recommendations:

1. Create a regional response team. Negotiate service agreements with adjoining counties.
2. Restrict team membership to Iowa City Fire Department personnel only.
3. Redirect management/coordination responsibilities to the Iowa City Fire Chief.

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INTRODUCTION

Problem Statement

A formal plan to analyze and evaluate the success of hazardous materials emergency response teams did not exist at the Iowa City Fire Department. This 52 member career department provides level one response, as defined by NFPA 471. The department also participates in a county-wide level two response team controlled by the county sheriff. The county team includes private and public sector members and responds to all level two spills within the county. Problems with volunteer retention, training, cost equity, and discordance cause this agency to question whether team structure and makeup changes might enhance program success.

Purpose Statement

The purpose of this research was to evaluate structure and configuration components of level two hazardous materials response teams in the Midwest. The results would yield improvement recommendations.

Research Methodology

The study uses evaluative research methodology to answer the following questions:

1. In evaluating success criteria for hazardous materials emergency response teams in the Midwest, what impact do the following factors have on success?
    a. geographical response boundaries.
    b. population served.

c. career, volunteer, or combination team structure.

d. the number of technicians.

e. member orientation (fire service, law enforcement, private sector).

f. single organization vs. multiple organization teams.

g. how long the team has been in existence.

h. who manages/coordinates the team.

2. For Midwest hazardous materials emergency response teams that provide service outside their normal jurisdiction, how is legal authority obtained?

3. How are Midwest hazardous materials emergency response teams funded?

BACKGROUND AND SIGNIFICANCE

As required by provisions of the Superfund Reauthorization Act of 1986, the Johnson County Local Emergency Planning Committee submitted a hazardous materials response plan on October 4, 1988. There are two issues in the plan that have created controversy to this day and give substance to my research. The first has to do with designating an incident commander at hazardous materials emergencies.

According to the plan, the senior law enforcement officer (which in our case is the county sheriff) will become the incident commander. The exception to the rule is if the spill or release occurs within the municipal boundaries of Iowa City the senior fire official becomes the incident commander. Additional background information involving

local experience with the incident command system centers around the ten fire districts in Johnson County and their first in the state 28E mutual aid agreement. Both the written agreement and the association's reputation for smooth integration of mutual aid companies have served as benchmark examples for the fire service in Iowa. The county sheriff doesn't have a comfortable working knowledge of the incident command system. As a result, his on scene role is largely symbolic and for most incidents he simply doesn't show up. What's evolved is a system whereby the fire chiefs routinely establish command and manage the incident to its conclusion.

The plan also gives the sheriff supreme authority over the county team. Five team members are elected to an executive board which provides operational management. The executive board reports to the sheriff, and a similar detachment problem exists here. Neither the sheriff nor his designee provide any leadership for the team and the group is frequently left to struggle, sometimes awkwardly on its own. Given the team's complex mixture of career and volunteer mix from public and private sector jobs, management and leadership challenges are considerable. Guidance and direction have been missing.

The Iowa City Fire Department is the only career fire department in Johnson County. Of its 52 members, 12 are hazardous materials technicians that belong to the county response team. The team currently has 30 technicians. Remaining technicians come from volunteer fire departments, law enforcement, and the private sector.

Since the team was formed in 1988, there have been ongoing problems with volunteer retention, providing and maintaining requisite training, record keeping, and

equitable cost sharing. The same problems exist today. A failure to resolve has become more apparent with the team's desire to extend coverage to adjoining counties. A failure of leadership has nearly made this an impossible goal.

Increasingly, questions about team structure, team makeup, and who or what agency should manage the team have surfaced. For our department, a method to evaluate the different configurations of Midwest hazardous materials response teams against prescribed goals and objectives was needed. That information could provide answers to our questions. The pursuit of those answers was the purpose of this research. The National Fire Academy's Strategic Management of Change class (S.M.O.C.) provided the necessary tools. The major component of S.M.O.C. was the change management model, a four-part process involving analysis, planning, implementation, and evaluation/institutionalism. The evaluation phase (task 4.l) of the change management model provided the outline for this research.

LITERATURE REVIEW

The purpose of the literature review is to examine excerpts and thoughts of others who have published materials on hazardous materials emergency response teams. The review will demonstrate how literature affected the results.

The Problem

According to the Department of Transportation (DOT), more than 575,000 chemical products are produced in over 11,000 chemical plants in the U.S. But are all chemical products hazardous materials? The DOT defines hazardous materials as: "substances or materials capable of posing an unreasonable risk to health, safety, property, and the environment when transported in commerce (Kales, Castro, and Christiani, 1996, p. 394)." The Environmental Protection Agency (EPA) divides them into four categories: extremely hazardous substances, hazardous substances, hazardous chemicals, and toxic chemicals. They range from the familiar to the bizarre, from chlorine gas to gasoline, to organophosphate pesticides, and hydrofluoric acid (EPA, 1988).

The Congressional Research Service estimates approximately 75% of Americans live in the vicinity of plants that produce, handle, treat, or store hazardous materials. Approximately 4 billion tons of regulated hazardous materials are transported each year throughout the United States. The DOT estimates there are about 500,000 hazardous materials shipments per day, or 183 million shipments per year (FEMA, 1993). The majority of hazardous materials are manufactured, stored, and transported

safely. But because the potential for disaster is so great, the need for safe handling, storage, transportation, and emergency mitigation is paramount. The deaths of six Kansas City firefighters when 45,000 pounds of ammonium nitrate/fuel oil exploded in November, 1988, clearly focused national attention on the dangers emergency responders face where hazardous materials are present (U.S. Fire Administration, 1988).

An Evolution of Concern

Twenty-five years ago, most of the federal, state, and local laws and regulations that address hazardous materials safety issues did not exist. In the wake of several major environmental incidents, Congress has mandated certain levels of preparedness and training for response personnel. Not being prepared could be cause for a very unpleasant experience. That experience could include monetary penalties, costs associated with bringing an operation into compliance, legal settlements, unnecessary environmental damage, personal injury, or even death (McMahon, 1996). "Whether or not you're prepared for them, hazardous materials are a fact of life, and the local fire department is going to be the first one summoned to deal with the problem (Birt, 1992, p. 24)."

Clean-up the Environment

The 1980s saw a significant increase in public awareness about hazardous waste. Numerous federal, state, and local laws were enacted to address what seemed to be a changing and growing problem. The country first began to hear and learn about unregulated disposal of hazardous waste with news of contamination of the Niagara

Falls, New York, neighborhood of Love Canal. Congress followed by passing the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) of 1980. The so-called "superfund" program allocated $1.5 billion to clean up hazardous materials spills and compensate state and local governments for their part in clean-up activities (National Governors' Association, Undated). By 1985, the notion that hazardous materials were confined to a few isolated locations had been dispelled. Congress was now estimating that there were as many as 10,000 sites across the country needing clean-up and that projected costs for such work exceeded $100 billion (EPA, 1988).

Attention was also focused on the problems associated with the transport of hazardous materials. In 1971, the Chemical Manufacturers Association established the Chemical Transportation Emergency Center (CHEMTREC) to provide information to emergency responders (Moyer and Francis, 1994). Fire departments were becoming more and more aware of not only the potential hazards involved, but also the technical skills and safety measures required to effectively mitigate a hazardous materials incident. During the 1980s, many fire departments began to develop their hazardous materials response capabilities (Browne, 1991).

Rules and Regulations

The Federal Hazardous Materials Transportation Act (HMTA) 1975, brought responsibilities previously delegated to other agencies under the control of the Department of Transportation. The act defined regulated materials, authorized the regulation of labeling and placarding of packages and containers, and preempted

conflicting state laws. Certain aspects of the legislation were expanded and built upon in 1990 with the passage of (HMTUSA) the Hazardous Materials Transportation Uniform Safety Act (FEMA, 1993).

The Bhopal, India, tragedy in December of 1984, in which a cloud of methyl isocryanate from a Union Carbide plant killed more than 2,500, followed eight months later by another accidental release at the Union Carbide plant in Institute, West Virginia, led officials to pass the Superfund Amendments and Reauthorization Act (SARA) in 1986. The Union Carbide events brought into focus how little information the public had on hazardous substances in their communities and on the inadequacies of emergency response (Moyer and Francis, 1994).

SARA was primarily an expansion of the superfund clean-up program. Two sections of the act provided new direction: Title I stipulated training requirements for emergency responders and Title III contained a new authorization, the Emergency Planning and Community Right-to-Know Act (EPCRA) designed to require community-wide planning for chemical emergencies. Title I linked skill requirements for first responders with an escalating level of functions to be performed. The standard established five levels of hazardous materials training: awareness, operational, technician, specialist, and on-scene incident commander. Title III authorized the appropriation of funds to be used for emergency preparedness programs, including training for hazardous materials incidents (Fire, 1990). Title III also established a new framework for improved community awareness and notification. The act required state and local emergency planning commissions (SERCs & LEPCs) be created to supervise

and coordinate the development of local emergency response plans (FEMA, 1993). According to FEMA, "These regulations cannot prevent hazardous materials incidents. They should, however, help provide the means of notifying the public of potential hazards and to help emergency planners and responders effectively manage potentially dangerous situations (FEMA, 1993, p. 9)."

Most injuries to emergency personnel occur during the first minutes of the incident response, before the full scope of the incident and its attendant dangers have been appreciated. A potential weakness of the Occupational Safety and Health Administration Hazardous Waste and Emergency Response Standard (1910.120) is that its scope appears to exclude employees working in the immediate release area and their activities in relation to incidental releases of hazardous substances (Kales, Castro, and Christiani, 1996, p. 399).

"The days of the dramatic derailment or chemical release are going to become less prevalent as industry specific regulations are developed and enforced (Kurzeja, 1995, p.29)." Just as EMS has evolved in the fire service, hazardous materials teams must be prepared to meet the challenges of environmental protection. "Our involvement will likely take us beyond life safety and incident stabilization to include prevention as well as start-to-finish incident mitigation (Kurzeja, 1995, p.31)."

The Environmental Protection Agency (EPA) has moved forward on its mandate from Congress under the Clean Air Act. Specifically, the Risk Management Planning (RMP) portion of the legislation is complete and according to its terms, facilities must now identify the worst case scenario for each site. Many in industry feel

the focus of planning should not be on the worst case scenario, but rather on the most probable scenario (Callan, 1994). The RMP will help make local emergency plans more comprehensive and reliable. On the preventive end, a chemical investigation board has been established under the Clean Air Act. The board will investigate accidents in order to establish corrective measures to minimize future accidents (Callan, 1994).

Another piece of legislation destined to have an impact is the Occupational Safety and Health Administration (OSHA) Reform Act. The purpose of the act is to bring up to date many OSHA programs, some of which have not been changed since the first OSHA Act in 1970. One piece of the legislation seeks to hold the supervisor or manager directly responsible for the death or serious injury of a subordinate during an emergency response. The act specifically details that, "The supervisor shall not be protected by the organization. The organization cannot pay for the defense, and, if found guilty, the supervisor, not the employer, must pay the damages (Callan, 1994, p. 20)."

Training

Training is a major consideration when addressing emergency preparedness for hazardous materials emergencies. Title I of SARA establishes minimum training standards for emergency responders. Responders are required to complete training based on the duties and functions they are to perform. The requirements are stated in terms of minimum hours of training and in terms of demonstrated competencies (OSHA, 1989). The content of the training is not specified. The five categories identified are:

1) Awareness. Trained to initiate an emergency response sequence by notifying the proper authorities. They would take no further action beyond notification.
2) Operations. Trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures.
3) Technician. Assume a more aggressive role. They will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.
4) Specialist. Their duties parallel those of the technician; however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain.
5) Incident commander. Will assume control of the incident scene (OSHA, 1989).

These levels are built on the premise that emergency responders must build on previous levels of competency as they progress (Brown, 1993).

Response teams that utilize personnel from various agencies face a difficult task in acquiring the necessary training. Integrating personnel from many different emergency response agencies and private industry into a cohesive haz-mat response team presents numerous challenges, not the least of which is requisite training. Some obstacles include: getting time off to attend, assuring appropriate quality and conformity, and the issue of who pays the bill (Brown, 1993). Remember, "Training doesn't always mean learning. Be able to prove your responders are competent by keeping complete and accurate training records (McMahon, 1996, p. 4)." "Remember too, haz-mat incidents are

materials driven. The more materials on-site, the broader the spectrum of training required to safely handle the incident (Browne, 1991, p. 25)."

Emergency Response

"Many small fire departments can afford the luxury of simply securing a haz-mat scene, conducting isolation and evacuation, and awaiting the arrival of trained industry specialists to resolve the incident (Hermann, 1993, p. 42)." In contrast, larger departments serving more populated areas that present significant exposure hazards, and a higher expectation of service demand incident mitigation by specialized haz-mat teams (Hermann, 1993).

In Iowa, the past decade has produced the following hazardous materials response changes for the Iowa fire service: a 28% increase in awareness level response capability, a 50% increase in operations level response capability, and a 41% increase in technician level response capability. And over the same time period, hazardous materials responses have doubled (Comito, 1997).

Funding

A major benefit of regional response teams is the ability to share costs. Departments are able to eliminate duplication of equipment and share in the purchase of new equipment. The Lake County Haz-Mat Response Team consists of 45 fire departments serving a population of 700,000, about 20 miles north of Chicago. Their response area covers approximately 1,000 square miles. Since its inception in 1985, the cooperative agreement has kept costs to a minimum. Each department has contributed only $7,500 to date (Cashman, 1994).

In Tarrant County, Texas, an 11 city fire mutual aid agreement was the precursor to the creation of the Northeast Hazardous Materials Response Team. A significant motivation in creating the team was a desire to provide, "A high caliber, well-equipped response to incidents involving hazardous materials, without increasing taxpayer burdens. Member cities currently pay $2,500 annually (Erwin, 1993, p. 19)."

Division of labor and cost sharing in Franklin County, Ohio, gave way to this unique response arrangement.

> The regional team consists of an airwagon and a special haz-mat medic unit from Perry Township, suit teams from Sharwood and Washington, a ladder company from Norwich that is responsible for decon and diking, a ladder company from Upper Arlington that is cross-trained in decon and diking, and an engine company from Grandview Heights that tows a foam trailer (Cashman, 1994, p.64).

Many regional response teams have enacted legislation to allow billing back the responsible party. Such arrangements make operating expenses recoverable, but require accurate record keeping. Other regional teams benefit from state funds to help finance their teams (Cramer, 1995). Like Oregon and New Jersey, the Commonwealth of Virginia provides funding for 19 locally based Hazardous Materials Response Teams (HMRTs) (Cashman, 1994). The regional response team in Cumberland County, Pennsylvania, is made up of four volunteer fire companies that maintain their own equipment, insurance and vehicles. The team does not receive county funds. It's only

outside funding comes from proceeds generated by equipment costs billed to the spiller (Cashman, 1994).

The haz-mat team in Pinellas Park, Florida, took advantage of a little known state tax on gross receipts of commercial hazardous waste facilities. By amending a local ordinance and making proper application for the tax revenue, Pinellas Park has been able to reimburse the general fund for overtime and training costs incurred during the past five years. A heavy rescue truck for use by the haz-mat team, air quality monitoring devices, and several SCBA units have been purchased through this unique funding source (Cramer, 1995).

A Southern California regional response team found that together they could accomplish more than anyone could alone. Due in part to its multi-agency approach, it was awarded a State of California grant for upgrading equipment. In 1995, its ruling commission decided the fortuitous and much heralded team approach show be allowed to grow. Today the team responds to multi-casuality incidents, urban search and rescue needs, and confined space emergencies (Bryan, 1996).

In the Dayton, Ohio, area, 37 participating departments joined forces to create a regional response team. Participating jurisdictions pay an annual per capita fee, and a buy-in fee equal to one-tenth of one percent of the jurisdiction's property value. The fees cover equipment purchases, training, and other costs (Birt, 1992). According to Chief Wright of the participating Greenville Fire Department, "The cost of initiating a haz-mat team can be an expensive endeavor, but failing to organize a system at all can be even more expensive (Birt, 1992, p. 23)."

Regional Response Teams

After six years of lobbying and debate that included the possibility of not responding to haz-mat incidents at all, the Oregon legislature approved a program that established designated regional response teams. By the end of 1992, Oregon had established ten regional response teams to provide a uniform level of haz-mat response coverage to the entire state (Birr, 1992). The intent of the program is "to provide advanced, OSHA haz-mat technician level service at major incidents throughout the state. The regional teams are not intended for haz-mat cleanup or disposal, nor for the simple standbys (Birr, 1992, p. 43)." In return, the ten fire department based teams receive equipment and training from the state for agreeing to respond out of their jurisdiction. The Oregon program was borne out of a frustration with an increasing number of incidents and the elevated pressure from OSHA requiring more training and better equipment for the responders (Garza, 1992).

A number of regional configurations have formed across the county around which to organize haz-mat response teams (HMRTs). Their presence seems to be borne out of the desire to provide cost effective emergency response. According to Rick Emery, coordinator of the Lake County HMRT,

> There are all kinds of people trying to form their own HMRTs, even though their own agency does not have a justifiable need for such an expense. Each department cannot spend the time or money to form a team. They need to band together into a regional response team, or the state needs to divide the area by regional teams and fund them with HMTUSA (Federal Hazardous

> Materials Transportation Uniform Safety Act of 1990) monies (Cashman, 1994, p. 64).

Regional response teams are now staffed, controlled, and paid for by fire departments in diversified geographical areas. The attraction of pooling existing resources to form HMRTs are creating formal, written resolutions of agreement across the country. Cashman points to success stories in Lake County, Illinois; Franklin County, Ohio; Sedalia-Pettis County, Missouri; Hamilton Township, New Jersey; Fredericksburg, Virginia; Cumberland County, Pennsylvania; and the Fort Worth metropolitan area of Texas, as benchmark examples. He concludes his article by saying,

> The evolution of regional hazardous materials response teams has provided fire departments with a reasonable, practical, and cost-effective solution to haz-mat response. In addition to providing team members with greater access to needed equipment, more buying power, and increased training, HMRTs offer the most essential element of all, increased safety to their members (Cashman, 1994, p. 66).

In the San Francisco Bay Area, a multi-jurisdiction haz-mat team serving a population of 222,000 in a three city area, has given way to a promising future based on the cooperation between agencies. "Cooperation to create what's best for the public and our departments (Garza, 1992, p.21)." Success and cooperation in managing the Northeast Hazardous Materials Response Team in Texas led that authority to add explosives response to their menu of services (Erwin, 1993).

Two cities south of Los Angeles with heavy industry decided they could work together as a haz-mat team despite the fact the two jurisdictions aren't contiguous. Santa Fe Springs and Vernon, California, fire chiefs state, "Some problems will be minor or small, but even these must be handled correctly to avoid escalation into a more serious situation (Schnabel and Telford, 1995, p. 36)."

Emergency Planning

A community's ability to cope with a potential emergency depends on its ability to plan for and respond to that incident (Moyer and Francis, 1995).

> The intention of the Emergency Planning and Community Right-to-Know Act (EPCRA) was to ensure that planning for chemical emergencies occurred at the local level. Local elected officials and response professionals are in a unique position to gauge the risk presented to a community by the presence of hazardous chemicals (FEMA, 1993, p. 30).

One weakness of Title III local planning requirements relates more to the diverse types of local government it is trying to address. The idea is that a strong, centralized government entity, one that provides the majority of public services, including police and fire, will stand a better chance of producing a realistic response plan (Callan, 1994). When a strong centralized county government does not exist, "There is a natural tendency toward independence, particularly in the absence of controlling authority. To exchange, share, and coordinate information across the multiplicity of independent fire and police departments without any real authority requires time, effort, energy, and

patience (FEMA, 1993, pp. 30 & 31)." In such cases, response plans may satisfy administrative requirements only.

Summary

Several pieces of federal legislation have and will continue to provide the driving force to hazardous materials emergency response. This review has not provided an exhaustive examination of those laws and requirements, but rather an abbreviated historical glimpse of how and why they have evolved. Local governments and emergency responders are constantly working to comply with these regulations in order to provide safe and effective emergency response.

Mandatory training and expensive equipment are two major challenges facing response agencies. Equipage and manpower sharing in the form of regional response teams that eliminate duplication and maximize available resources is a solution that can work. The review provided a brief glimpse at several successful regional teams.

Federal legislation has indeed focused state and local attention on the hazardous materials problems they face. The awareness and additional information they've provided has helped some jurisdictions to better prepare themselves. Sometimes the information leads to little more than a paper response to an administrative requirement. Local planning should be the result of cooperative input. Decisions are meant to be well reasoned, justified, and based on fact. In a perfect world, issues of community and/or agency pride and turf battles would not be allowed to corrupt those decisions.

PROCEDURES

A literature review of contemporary published documents on the subject was the first step to completing this research. A comprehensive search for articles was initiated at the National Fire Academy's Learning Resource Center (LRC). And, most of the published information included in the review came from the LRC. A state survey and analysis of the Iowa fire service was another important part of the review. I felt it necessary to first obtain a concept of "best practices" and "contemporary wisdom" on how and why hazardous materials teams are structured the way they are from leaders in the field.

Next, a survey instrument was prepared, tested, and distributed (Appendix A). The purpose of the survey was to provide research data necessary to answer research question number one. Evaluative methodology and the survey data were used to evaluate the success of Midwest level 2 hazardous materials emergency response teams. Raw data was placed into a Microsoft Access database program to provide sorting and analysis capabilities. A staff member from our Information Services Office provided technical support in formatting the data.

Survey questions were designed around Task 4.1 of the Change Management Model (Appendix B). The Change Management Model is the framework of the EFOP course titled, "Strategic Management of Change." The Change Management Model exists to help bring control and direction to change chaos as it is based on a systematic progression to help facilitate change. This research uses phase four of the model which

offers a methodical approach to evaluation. Once a program or any kind of change has been implemented, it must be continuously and systematically monitored to make sure it is functioning as predicted. There are seven parts of the Task 4.1 evaluation. They include: 1) evaluate the implementation against the initial change goals, 2) evaluate the implementation against the described future state, 3) evaluate how well established, or institutionalized, the change becomes, 4) evaluate how rapidly the change was accomplished, 5) evaluate costs to individuals and the organization of conducting the change, 6) identify costs to individuals and the organization of conducting the change, and 7) assess initial resistance to change. Thirty survey questions were used to assess the seven success criteria.

The survey was conducted anonymously; however, eight questions of the 40 question survey appraise team structure and makeup. That information would give substance to the research as the success criteria responses were sorted and examined according to the structure and makeup of a team. The resulting data would provide answers to research question number one and give cause to program recommendations.

Questions two and three of the survey correspond to research questions two and three. The questions are separate and distinct in that their sole purpose is to provide the answers to research questions two and three. They are open-ended (allowing respondents to answer in their own words) to obtain as much information as possible. Appendix C includes summary information for each of the first ten questions.

Questions 11 - 40 were structured around closed-ended (yes/no or multiple choice) and forced-choice (multiple choice response which does not include "no opinion" or "not applicable") responses to provide uniformity and ease of analysis. In order to measure and quantify success criteria data, a Likert measurement scale was used (Likert, 1961). A numbered response from one to five, with 1 being "never true" and 5 being "always true" gave value to the responses and provided a means to numerically measure results. Four questions required distinct and special computation formulas in the database query due to their style. They included: a 13 part standard operating procedure checklist question (#25) and three true/false questions (27, 28, 29).

A representative sample of survey recipients was selected from a published directory of hazardous materials emergency response teams (Cashman, 1996). Midwest response teams were the target audience. Survey recipients included all teams listed in the directory for: Michigan, Iowa, Wisconsin, Minnesota, South Dakota, Illinois, Missouri, Kansas, and Nebraska. A total of 150 surveys were mailed on December 1, 1997. According to material in the National Fire Academy's Executive Development student manual, a population size of 150 requires a sample size of 108 to assure a 95% confidence level. The sample obtained for this research exceeded that requirement by six. A total of 114 surveys were completed and returned; therefore, confidence level exceeds 95 percent.

Survey questions 11 - 19 represent the first success criteria by evaluating haz-mat teams against initial change goals. The questions were taken from the OSHA

hazwopper rule (29 CFR 1910.120). They are clearly stated federal requirements for each and every haz-mat team. They are explicit, quantifiable, and have served to guide in the development of all hazardous materials emergency response teams.

Questions 20 - 27 evaluate teams against a described future state. To assess this criteria, I used selected provisions from the latest editions of NFPA 471 and 472. "Recommended Practices for Responding to Hazardous Materials Incidents," NFPA 471 represents a well articulated and envisioned state for haz-mat teams to aspire to. NFPA 472 is titled, "Professional Competence of Responders to Hazardous Materials Incidents." Unless specifically adopted by the local authority, NFPA 471 and 472 carry no requirements of law, but do express a desired set of guidelines. One question was included that sought to identify locally established standard operating procedures and that list was assembled from various articles in the literature review.

Evaluation criteria number three looks at how well established, or institutionalized, the team has become. Questions 28 - 35 provide the data for the analysis. Precepts of NFPA 471 and 472 are used throughout. This time only those issues related to measuring the team's ability to sustain behaviors or activities were selected. For example, does regular review of MSDS Sara Title III information take place? Is there coordination with outside agencies that includes detailed resource information and methods for sharing? And, is pre-planning emergency response to fixed site and transportation spills a routine and established activity for the team? These are examples of questions used to assess how well established, or institutionalized, the team has become.

The fourth criteria evaluates how rapidly the change was accomplished. Using the Likert scale with 1 being slow and 5 being rapid, respondents were asked to characterize how quickly the change process unfolded in the formation and development of their team. The question makes reference to local circumstances and a sense of urgency as influencing factors.

Questions 37 and 38 quantify the costs to the organization and the individual, the fifth criteria. Criteria six and seven are also direct and straight forward assessments with one question devoted to each criteria. All are given numerical value by use of the Likert response scale. It is important to note that the last two criteria favor a low numbered response. The first five success criteria are judged better or best with a higher numerical response.

Once the surveys had been returned and data entry was complete, my assistant from Information Services and I constructed the database queries and reports which became the method to measure and evaluate success criteria. First I developed a report that would look at the eight team makeup characteristics and the corresponding success criteria scores (Appendix D). Highlighted entries from each category represent the best scores in that criteria. Next, I formulated queries and reports to delineate success criteria for every possible combination in questions 1 through 10. For example, a query and report was created to yield combination success criteria for questions five and nine. The report combines career, volunteer, and combination responses with the years in existence responses

(0 - 3, 4- 10, 11 and over). Reports were created for every combination to examine resulting success criteria. An unofficial research question became, what combinations of characteristics yield favorable evaluation scores? The combining of queries caused the database to swell enormously. It currently sits at 7.33 megabytes. It is much too large to print in its entirety. An arithmetic mean was calculated to show variance and standard deviation calculations. Lastly, a report was generated for our own hazardous materials response team, based on their completed survey to provide cause and justification for research recommendations.

Limitations

The demographic breakdown of survey respondents reveals some limitations to the research. Only one hazardous materials response team is listed as responding to manufacturing/industrial site(s) only. A single entity yet the resulting data received equal consideration in interval scales analysis for industrial, fire service, public safety, or public/private sector teams. When you look at the data, you see a very favorable set of numbers for manufacturing/industrial teams, even though only one industrial team survey was returned.

Similarly, other demographic groups were only modestly represented in the research. They included: all volunteer teams (7), combination public safety teams (7), teams managed/coordinated by a county sheriff or other law enforcement designee (5), and teams managed/coordinated by an elected board, commission, or individual (4).

Definition of Terms

Interval Scale - Ranking information based on equal units. Gives information concerning the actual amount of a trait or characteristic.

Mean - The arithmetic mean is commonly known as the "average." It is computed by adding all observations and dividing by the number of observations.

Standard Deviation - The square root of the variance. The most useful of the common measures of dispersion.

Variance - The mean of the squared deviation scores about the mean of a distribution. To calculate, first figure the distance of each observation from the mean of all observations (the deviation from the mean). Then, square each deviation, add those squared deviations, and divide the sum of the squared deviations by the number of observations. A small variance indicates that the data points are close to the mean.

RESULTS

This section of the research answers each of the original research questions. I will summarize findings from the research, presenting all data used to derive the results. The data is in the form of interval scales, ranking information that reflects the actual amount of a success criteria. There are seven success criteria in the Change Management Model, thus seven columns of numbers. The numbers reflect values for each success criteria expressed in an interval scale and in a two decimal numerical format.

Column 1 Evaluates against initial change goals.

Column 2 Evaluates against the described future state.

Column 3 Evaluates how well established, or institutionalized, the program has become.

Column 4 Evaluates how rapidly the program was accomplished.

Column 5 Evaluates the costs to individuals and the organization in developing the team.

Column 6 Identifies the number of unanticipated actions and occurrences (lower number is preferable).

Column 7 Assesses initial resistance (lower number is preferable).

Be mindful that the first five success criteria favor a high number and a low number is desired for the last two criteria. Highlighted numbers designate the best score for each criteria.

Research Questions

1. In evaluating success criteria for hazardous materials emergency response teams in the Midwest, what impact do the following factors have on success?

    a. **geographical response boundaries.**

Municipal	4.38	3.77	3.23	3.50	2.91	3.19	2.75
Industry	4.44	4.52	4.88	4.00	4.00	3.00	1.00
Metro	4.56	4.35	3.91	3.05	3.78	2.89	2.74
County	4.41	4.23	3.53	2.78	3.28	3.09	2.70
Regional		4.57	4.35	3.86	3.12	3.75	3.06
2.50							

Industry scored best in the geographic response issue with five of seven success criteria ranking best on the interval scale. Regional and metro teams were slightly better at meeting initial change goals and the metro teams were slightly better at expecting the unexpected.

    b. **population served.**

< 50,000	4.36	3.93	3.54	3.12	3.33	2.84	2.68
50 - 100K	4.53	4.28	3.66	2.85	3.26	2.90	2.25
100 - 500K	4.53	4.38	3.77	3.09	3.63	3.04	2.69
500K - 1 mil	4.63	4.26	3.95	3.29	4.00	3.57	2.57
1 mil	4.54	4.31	3.70	3.43	3.33	3.29	2.86

There is not a clear leader in the category of population served. Generally, those teams serving a population base of 500,000 and up have the best scores in the first five success criteria with the final two criteria, anticipating the unanticipated and resistance to change, best managed by the smaller populations.

c. **career, volunteer, or combination team structure.**

Career	4.53	4.30	3.79	3.18	3.53	3.08	2.64
Volunteer	4.21	3.73	3.55	3.00	3.14	2.86	2.43
Combination	4.52	4.22	3.59	2.94	3.63	3.03	2.55

The career team structure ranked best in four of seven criteria. Volunteer teams were best at anticipating the unanticipated and at facing the least amount of resistance. The combination structure was slightly higher than career teams in the category that measures benefits to the individuals and costs to the organization.

d. **number of technicians.**

< 20	4.41	4.00	3.48	3.08	3.49	2.74	2.43
21 - 40	4.55	4.28	3.78	3.12	3.49	3.18	2.75
41 - 75	4.54	4.57	3.88	2.81	3.56	3.25	2.44
>76	4.60	4.43	4.06	3.56	3.89	3.22	2.78

The smaller teams with fewer than 20 technicians were best able to anticipate the unanticipated and at facing the least amount of resistance. The largest teams, those with 76 and more technicians, were best in four of seven criteria including: implementation in relation to initial change goals, how well the program is established, how quickly the program evolved, and in providing benefits to the individuals and in keeping costs to the organization fair and equitable.

e. **member orientation (fire service, law enforcement, private sector).**

Fire	4.54	4.38	3.84	3.12	3.62	3.08	2.62
Public safety	4.32	3.70	3.14	3.14	3.57	2.86	3.14

Industry	4.51	4.02	3.84	4.17	3.75	2.33	2.00
Public/private	4.42	3.96	3.39	2.70	3.13	3.25	2.55

The fire service scored highest in the first two criteria and industry scored best on the final four. The two matched each other for best score on the criteria that evaluates how well established, or institutionalized the program has become.

f. **single organization vs. multiple organization teams.**

Single	4.54	4.26	3.78	3.20	3.52	2.97	2.47
Multiple	4.46	4.21	3.64	2.96	3.54	3.17	2.79

Teams formed from a single organization produced better scores than those from multiple organizations. Six of seven criteria were scored best for the single organization teams. And the seventh, evaluating costs to individuals and the organization, was nearly even.

g. **how long the team has been in existence.**

0 - 3 years	4.47	4.17	3.64	2.60	3.35	3.30	2.90
4 - 10 years	4.47	4.18	3.61	3.18	3.53	3.04	2.66
11 years and over	4.55	4.33	3.88	3.11	3.58	3.02	2.47

Another clear winner! Teams that have been in existence for 11 years and over scored best in six of seven criteria. Criteria four, which evaluates how rapidly the change was accomplished, yielded only slightly higher scores by the four to ten year old teams.

h. **who manages/coordinates the team.**

Fire Chief	4.54	4.37	3.81	3.02	3.55	3.08	2.55

Sheriff	4.09	3.32	3.17	2.40	2.60	3.00	2.40
Appointed	4.53	4.13	3.57	3.40	3.80	3.00	2.86
Elected	4.17	3.49	3.41	3.25	3.00	3.50	3.00

Teams managed or coordinated by a fire chief scored best in criteria one, two, and three. Criteria four and five were scored best by teams under the management or coordination of an appointed board, commission, or individual. Criteria number seven, which evaluates initial resistance, received the best score by teams managed by a county sheriff or other law enforcement designee. The sheriff and the appointed manager/coordinator tied for best on the criteria that measures at how well teams anticipated the unanticipated.

2. **For Midwest hazardous materials emergency response teams that provide service outside their normal jurisdiction, how is legal authority obtained?**

[60] mutual aid contracts
[15] other contract language
[23] local, state, or federal code provisions
[11] N/A
[5] other . . . . . Inter-governmental agreements

State contract (MN) and a joint powers agreement

MABAS

Regional response team

Through billing the responsible party

Survey respondents were allowed to check one box only. The numbers represent the total for each method. The responses tell us that 53% of hazardous materials response teams in the Midwest obtain legal authority to go outside their normal jurisdiction through mutual aid contracts, clearly the most common method. Only 10% of all

respondents do not provide service beyond their normal jurisdiction. Twenty-three teams obtain legal authority through local, state, or federal code provisions and 15 others by other contract language. Only five respondents indicated "other" methods of obtaining legal authority and those responses are indicated above.

3. **How are Midwest hazardous materials emergency response teams funded?**

[79] taxation
[22] special per capita assessment
[54] fee for service
[21] contract fees
[12] other . . . . . State contracts (3)
Paid industrial team
State grants (2)
Private grants (2)
Hazardous substance fund
Donations (2)
DOD Air Force installation

For this question, respondents were allowed to check all that apply. Because of that, the total is well beyond the 114 surveys returned. Clearly, tax revenue and fee for service are the most mentioned sources of funding. Special per capita assessments were identified 22 times and contract fees 21 times as sources of funding. Finally, there were 12 surveys returned with "other" funding sources identified. Those other sources are listed above.

Additional and Unexpected Findings

In comparing the interval rankings of success criteria in combination queries, those that look at two questions at the same time, certain parings ceded results that merit review. From questions five and nine with best combination scores in all seven success criteria and a standard deviation of .18,

Teams made up of all career members and have been in existence for 11 years and over.

1	3	4.61	4.47	3.97	3.26	3.73	3.00	2.41

From questions five and nine with best scores in all seven success criteria and a standard deviation of .17,

Combination career/volunteer teams that have been in existence from four to ten years.

3	2	4.57	4.35	3.62	3.10	3.88	2.85	2.45

From questions seven and ten with best scores in all seven success criteria and a standard deviation of .55,

Teams made up of fire service personnel only and are managed/coordinated by an appointed board, commission, or individual.

1	3	4.73	4.57	4.22	3.80	4.60	2.80	2.60

From questions five and seven with best scores in six of seven criteria and a standard deviation of .28,

Combination career/volunteer teams made up of fire service personnel only.

3	1	4.62	4.54	3.95	3.00	4.08	2.85	2.38

From questions eight and nine with best scores in six of seven criteria and a standard deviation of .30,

All team members come from one organization and the team has been in existence for eleven years and over.

Yes	3	4.70	4.53	4.01	3.33	3.69	2.92	2.04

From questions eight and nine with best scores in five of seven criteria and a standard deviation of .36,

All team members not from a single organization and the team has been in existence for 0 - 3 years.

No	1	4.70	4.86	3.92	3.00	4.17	3.00	2.67

Three responses from questions seven and nine with best scores in five of seven criteria with standard deviations of .23, .52, and .27 respectively,

Fire service personnel only and in existence for 11 years and over.

1	3	4.65	4.63	4.04	3.10	3.77	3.10	2.38

Combination public safety personnel and in existence for 0 - 3 years.

3	1	4.78	5.00	3.88	3.00	4.50	3.00	2.00

Combination public/private team personnel and in existence for 0 - 3 years.

5	1	4.44	4.57	3.63	3.00	4.00	3.00	3.00

Three responses from questions nine and ten with best scores in five of seven criteria with standard deviations of .27, .26, and .25, respectively,

Teams 0 - 3 years old with an appointed board, commission, or individual to manage/coordinate.

1	3	4.44	4.57	3.63	3.00	4.00	3.00	3.00

Teams 4 - 10 years old with an appointed board, commission, or individual to manage/coordinate.

2	3	4.64	4.43	3.53	3.44	4.00	2.89	2.67

Teams eleven years and older and with a fire chief to manage/coordinate.

3	1	4.65	4.66	4.08	3.00	3.68	3.10	2.31

From questions five and ten with best scores in five of seven criteria and a standard deviation of .27,

Combination career/volunteer teams that are managed/coordinated by a fire chief.

3	1	4.62	4.53	3.78	2.62	3.77	2.85	2.31

And from questions one and ten with best scores in five of seven criteria and a standard deviation of .22,

Regional response teams managed/coordinated by a fire chief.

5	1	4.61	4.54	3.95	2.97	3.84	3.06	2.35

The arithmetic mean for all responses is:

4.50	4.24	3.72	3.10	3.53	3.05	2.60

And lastly, survey response scores for our local emergency response team (JCHMRT) are:

4.00 3.98 3.00 1.00 2.50 4.00 3.00

JCHMRT scores reflect a standard deviation of 1.04.

DISCUSSION

Haz-mat tragedies, like the one in Kansas City, where six firefighters were killed when 45,000 pounds of ammonium nitrate/fuel oil exploded and in Bhopal, India, where 2,500 people died from a methyl isocryanate release from a Union Carbide plant have focused attention on hazardous materials and on proper procedures for mitigating an emergency. Federal laws with strict reporting and response criteria have evolved in their wake. By law, local response agencies now receive worst case scenario information from local facilities to help them plan (Callan, 1994). And federal monies to offset training costs are now becoming available.

Another benefit of increased federal involvement in hazard mitigation is a clear understanding of what it means to be successful in this field. The volumes of clearly articulated recommended practices (e.g., NFPA 471 & 472) and OHSA laws for emergency mitigation (29CFR1910.120) are explicit, precise, and quantifiable. They have made it easier to develop evaluation tools and extract measurements of success.

"The evolution of regional hazardous materials response teams has provided fire departments with a reasonable, practical, and cost-effective solution to haz-mat response (Cashman, 1994, p. 66)." Stories about successful regional teams were abundant in the literature review. It seems that maximizing resources and minimizing duplication have driven the movement. A regional team in Southern California found that together they could accomplish more than anyone could alone (Bryan, 1996). Some of the regional configurations have been so successful that the framework is now extending to other services, such as confined space, multi-casualty incidents, bomb squads, and urban search and rescue needs. Oregon saw the benefits of regional teams and took early steps to institutionalize the change.

Survey results submit regional teams are enjoying success in the Midwest. The criteria scores from research question 1(a.) indicate regional teams are more successful in every success criteria when compared to municipal and county-wide teams. The solitary industry based team produced the best scores among the response options. Regional and metro teams generated very similar scores of .11 and .15 standard deviations, respectively. Their similarity in scores may reflect a similar response component. Chances are every metro team has had to negotiate and operate under written response agreements with metropolitan communities, similar to the multi-county regional teams. In a sense, metro teams could be thought of as regional teams that respond to an urban area only.

The literature also emphasized the importance of local emergency planning. A community's ability to cope with an emergency depends on its ability to plan for and

respond to that incident (Moyer and Francis, 1995). According to FEMA, a strong, centralized government entity, one that provides the majority of public services, including fire and police, will stand a better chance of producing a realistic response plan. "To exchange, share, and coordinate information across the multiplicity of independent fire and police departments without any real authority requires time, effort, energy, and patience (FEMA, 1992, pp. 30 & 31)." Unfortunately, the role and strength of local emergency planning in haz-mat team success was not part of this research. I suspect there is a direct correlation and believe the subject merits study.

The research consistently demonstrated that smaller constitutes fewer unanticipated actions and less resistance to change. No surprises here. Whether in population served or the number of team technicians, size is the operative function. It joins volunteer teams and those managed by a Sheriff as best minimizing unanticipated actions and resistance to change. Unfortunately, the same groups perform poorly in the remaining categories.

How long a team has been in existence provided some very interesting data. In general, older teams enjoy more success. However, when other variables are factored, we learn, for example, that combination career/volunteer, combination public/private, and combination public safety teams obtain their optimum scores much earlier. It's as if the combination teams peak early and then begin to wane, which makes me wonder what became of slow, steady improvement. Is there a definite correlation between combination teams and a success curve that over time peaks early and then falls off? The data suggests so. Similarly, the data tells us that younger teams (0 - 10 years old)

perform best when managed/coordinated by an appointed board, commission, or individual. The older ones enjoy the most success when managed/coordinated by a Fire Chief.

From an organizational standpoint, our perception of problems and discord at the local level are verifiable by survey data. The JCHMRT survey results reflect a standard deviation of 1.04. Those numbers are clearly too far removed from the mean and call for changes, which affords significant implications to our organization.

RECOMMENDATIONS

From the research, it is possible to make recommendations based on results obtained in the findings. For this research, the recommendations involve changing team structure and makeup of our level two hazardous materials response team. The 1.04 standard deviation range in our program evaluation points to important shortcomings. The survey evaluation should in no way discredit the talented individuals that make-up the team. Many have given selflessly over the years and hold a strong desire to transcend. Yet, enduring problems with leadership, cost sharing, and volunteer retention join the immoderate fall from other Midwest team success levels in calling for change.

Some characteristics of team structure and makeup cannot be controlled. How long the team has been in existence cannot be manipulated. Other components, such as

the number of technicians, require budget authority to modify. And, changes in leadership or agency representation are extremely sensitive political issues that are seldom easy to predict, much less plan for.

Notwithstanding all of that, recommendations surfaced which call for revisions in all levels of how the team is composed and organized. Geographical response boundaries are usually thought to be unalterable. Regional haz-mat teams attenuate response boundaries by extending service coverage beyond normal jurisdiction through special agreements. Contemporary literature was the driving force behind this recommendation. So much has been written on regional haz-mat teams and all of the literature speaks to their success. The concept of service sharing and efficient use of resources is very current and extremely powerful with the taxpayer. The study supports the recommendation by indicating program success will be improved by making the team regional. Furthermore, the study tells us larger populations and more technicians enhance program success. Making the team regional should increase both population served and the number of team technicians. The first recommendation then is to aggressively negotiate service agreements with adjoining counties to extend our service coverage and make our haz-mat team a regional response team.

The second recommendation involves the makeup of team personnel. Survey data supports the effort to restrict membership to a single, career fire service organization. Three research ingredients are part of this recommendation: Part one is to fill the team with all career employees. Second, to restrict membership to fire service personnel only. And third, to draw members from a single organization.

Recommendation number two is to abridge team membership to Iowa City Fire Department personnel only.

The final recommendation involves who should manage/coordinate the team. Survey data imparts little redeeming value in having a sheriff as the manager/coordinator, and local sentiment would seem to support the data. A much better structure, I believe, and one supported by the study would be to place management and coordination responsibilities with the chief of the Iowa City Fire Department.

In summary, current literature and data from the study combine to support the following recommendations:

1. Create a regional response team. Aggressively negotiate service agreements with neighboring counties.
2. Limit team membership to Iowa City Fire Department personnel only.
3. Redirect management/coordination responsibilities to the Iowa City Fire Chief.

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APPENDIX A

Iowa City Fire Department
Serving With Pride & Professionalism
410 East Washington St.
Iowa City, Iowa 52240
(319) 356-5260

December 1, 1997

Dear Haz-Mat team leader:

I am in the process of gathering data about hazardous materials response teams in the Midwest. The information will be used to support a research project I am completing for a National Fire Academy EFOP class. I would appreciate your cooperation and sincere efforts to help me understand the relationship between team structure and development by completing and returning the enclosed survey.

The study is conducted anonymously with only team size and makeup questions that are necessary to analyze the results. The instructions are simple: merely indicate your response by marking the appropriate box or numbered reply. Insert the completed document in the postage paid envelope and place it in the mail.

The survey will take about 10 minutes to complete. I know your time is valuable. But please do not overlook the importance of your contribution. In order to evaluate effectively and assure confidence in the results, you participation is crucial.

Please complete and return the survey by Friday, December 19. If you desire, I will be happy to share the results of the survey.

Thank you in advance for your cooperation

Sincerely,

Roger W. Jensen, Fire Marshal
Iowa City Fire Department

Hazardous Materials Emergency Response Team Survey

NOTE: For the purpose of this research, a haz-mat team must possess a minimum **level two response capability** (NFPA 471) and at minimum **technician level responders** (29CFR 1910.120, paragraph q).

1) Our haz-mat team routinely responds to hazardous spills:

[ ] strictly within city or municipal boundaries
to specific manufacturing/industrial site(s) only
[ ] beyond our city boundary but within metropolitan area
[ ] within the county
[ ] to a multi-county or regional response area

2) If service is provided outside your jurisdiction, legal authority is granted through:

[ ] mutual aid contracts
[ ] other contract language
[ ] local, state, or federal code provisions
[ ] other *specify* _____
[ ] N/A

3) Our team receives funds from *(check all that apply)*

[ ] taxation
[ ] special per capita assessment
[ ] fee for service
[ ] contract fees
[ ] other *specify* _____

4) Population served

less than 50,000
50,000 to 100,000
[ ] 100,000 to 500,000
[ ] 500,000 to 1,000,000
[ ] over 1,000,000

5) Describe the makeup of your team:

all career
all volunteer
[ ] combination

6) How many technicians:

20 or fewer
21 - 40
41 - 75
76 and over

7) Our team is made up of:

fire service personnel only
[ ] law enforcement personnel only
[ ] combination public safety personnel
[private sector/industry based only
combination public safety/private sector

8) All team members come from one organization:

[ ] yes
[ ] no

9) Our team has been in existence for:

[ ] 0 - 3 years
[ ] 4 - 10 years
] 11 years and over

10) The team is managed/coordinated by:

[Fire Chief or designee
County Sheriff or other law enforcement designee
an appointed board, commission, or individual
[an elected board, commission, or individual

11) A written emergency response plan is developed and implemented to handle anticipated emergencies prior to the commencement of emergency response operations.

Always true *Never true*

5 4 2

12) The senior emergency response official responding to an emergency becomes the individual in charge of a site-specific Incident Command System.

Always true *Never true*

5 4 3 2 1

13) To the extent possible, all hazardous substances or conditions present are identified and appropriate site analysis, maximum exposure limits, and hazardous substance handling procedures are identified.

Always true *Never true*

4 3 2

14) Based on the hazardous substances present, suitable steps are taken to assure personal protective equipment is appropriate for the hazards to be encountered.

Always true *Never true*

5 4 3 2

15) Team members engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard wear positive pressure self-contained breathing apparatus while engaged in emergency response, until such time that the individual in charge determines that a decreased level of respiratory protection will not result in hazardous exposures.

Always true *Never true*

4 3 2

16) The individual in charge limits the number of emergency response personnel at the emergency site, in those areas of potential or actual exposure to incident or site hazards, to those who are actively performing emergency operations. And, operations in hazardous areas is performed using the buddy system in groups of two or more.

Always true *Never true*

5 4 3 2

17) Back-up personnel stand by with equipment ready to provide assistance or rescue. Advance first aid support personnel also stand by with medical equipment and transportation capability.

Always true *Never true*

5 4 3 2

18) The individual in charge designates a safety official, who is knowledgeable in the operations being implemented at the emergency response site, with specific responsibility to identify and evaluate hazard and to provide direction with respect to the safety of operations for the emergency at hand.

Always true *Never true*

4 3 2

19) When activities are judged by the safety official to be an IDLH condition and/or to involve an imminent danger condition, the safety official has authority to alter, suspend, or terminate those activities.

Always true *Never true*

5 4 3 2

20) The incident management system includes a standard personnel identification system to maintain accountability for each member engaged in activities at an incident scene.

Always true *Never true*

5 4 3 2

21) The incident management system includes a standard operating procedure to evacuate personnel from an area where an imminent hazard condition is found to exist and account for the safety of personnel. The system includes a method to immediately notify all personnel in the affected area of an imminent hazard condition by means of audible warning devices.

Always true *Never true*

5 4 2

22) Provisions for rest and rehabilitation include medical evaluation and treatment, food and fluid replenishment, and relief from extreme climatic conditions.

Always true *Never true*

5 4 3 2

23) A debriefing is held for those involved in decontamination as soon as practical.

Always true *Never true*

5 4 3 2

24) Pre and post-entry medical monitoring is performed on all individuals wearing chemical liquid splash-and vapor-protective clothing and performing hazardous materials operations.

Always true *Never true*

4 3 2

25) Our team management system includes comprehensive standard operating procedures for:

(check all those for which a standard operating procedure exists)

[ ] Incident Response – How will the team be notified? How will it get there? What is its expected role?

[ ] Control Zones – What criteria establishes the hot, cold and warm zone so as to isolate the incident and protect others?

[ ] Hazard and Risk Assessment – How will the product be identified, the identity confirmed? What resources will be used for hazard assessment?

[ ] Monitoring Instruments – What type to use? How often are the instruments recalibrated? How are they to be used?

[ ] Incident Command – Who is in charge of the team and the incident? Who has the authority to call for outside assistance? What federal, state, and local requirements are there for reporting the incident?

] Safety Officer – Who? What is his/her authority? What is that person's role?

[ ] Personal Protective Equipment – What is available? How is it to be selected and maintained? What limits can be anticipated?

[ ] Decontamination – What will be needed? Who is responsible for doing it? What is to be done with equipment that cannot be decontaminated? When must it be set up? What is acceptable minimum emergency decontamination?

[ ] Site Entry – How many people will enter? Who will be the backup team? What must be done before the site entry is attempted?

[ ] Control and Confinement – What equipment is available? How is it to be used? Are there special considerations such as floor drains, parking lot runoff or the reactivity of the containment material with certain products on-site?

[ ] Termination and Record Keeping Procedures – the how, what, when, and where of an incident. Essential recorded information for exposure records, operation critique and future reference.

[ ] Medical Surveillance – Medical surveillance requirements for pre- and post-entry as well as a protocol for having medical assistance available.

[ ] Training – Requisite hours and competencies for both certification and annual recertification.

26) As a guide in decision making, action guides or decision trees (checklists) have been developed for use by our team.

Always true *Never true*

4 3 2 1

27) As outlined in NFPA 472, Chapter 7, hazardous materials Branch Officer competencies are being used by our team.

Yes *No*

[ ] [ ]

28) The hazardous materials emergency plan is reviewed and updated annually.

Yes *No*

[ ] [ ]

29) A training exercise is conducted annually to determine the adequacy and effectiveness of the hazardous materials emergency plan.

Yes *No*

[ ] [ ]

30) All monitoring equipment is operationally checked prior to use and periodically calibrated in accordance with manufacturers' specifications.

Always true *Never true*

5 4 3 2

31) Training and recertification programs address competencies as well as required hours.

Always true *Never true*

5 4 3 2

32) Radio frequencies are "dedicated" and not shared with other agencies.

Always true *Never true*

5 4 3 2

33) Pre-planning emergency response to fixed site and transportation spills is a routine and established activity for our team.

Always true *Never true*

5 4 3 2

34) Coordination with outside agencies includes detailed resource information and methods for sharing.

Always true *Never true*

4 3 2

35) Our team regularly reviews MSDS Sara Title III information.

Always true *Never*

5 4 3 2 1

36) The pace of a teams' inception and formation is influenced by local circumstances and by a sense of urgency. Characterize how quickly the process unfolded in the formation and development of your team.

Rapid *Slow*

4 3 2

37) The economic costs of developing and maintaining our hazardous materials response team have been fairly and equitably shared.

Strongly agree *Strongly disagree*

5 4 3 2 1

38) Members of the organization(s) affected by haz-mat consider, on a personal level, the program to be more of a benefit than a burden.

Benefit *Burden*

5 4 2

39) Program development and implementation bring certain unanticipated actions and developments. Did the implementation of your haz-mat team yield a high or low number of unanticipated actions and occurrences?

High number *Low number*

4 2

40) The last question looks at initial resistance to implementing your haz-mat team. Whether from a lack of understanding or acceptance of the change, would you characterize the number of resistance efforts (efforts to maintain the status quo) as high or low?

High number *Low number*

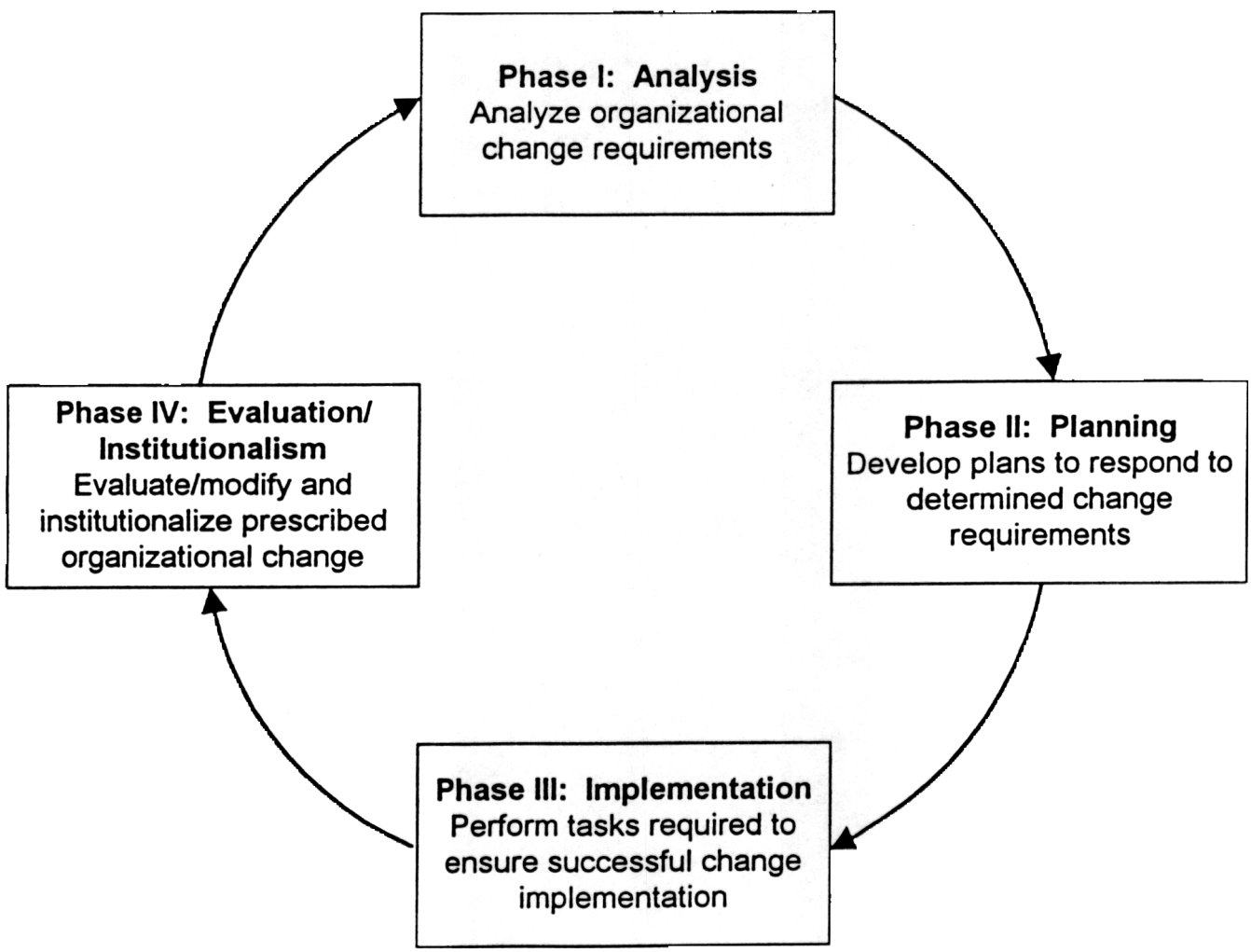
5 4 3 2 1

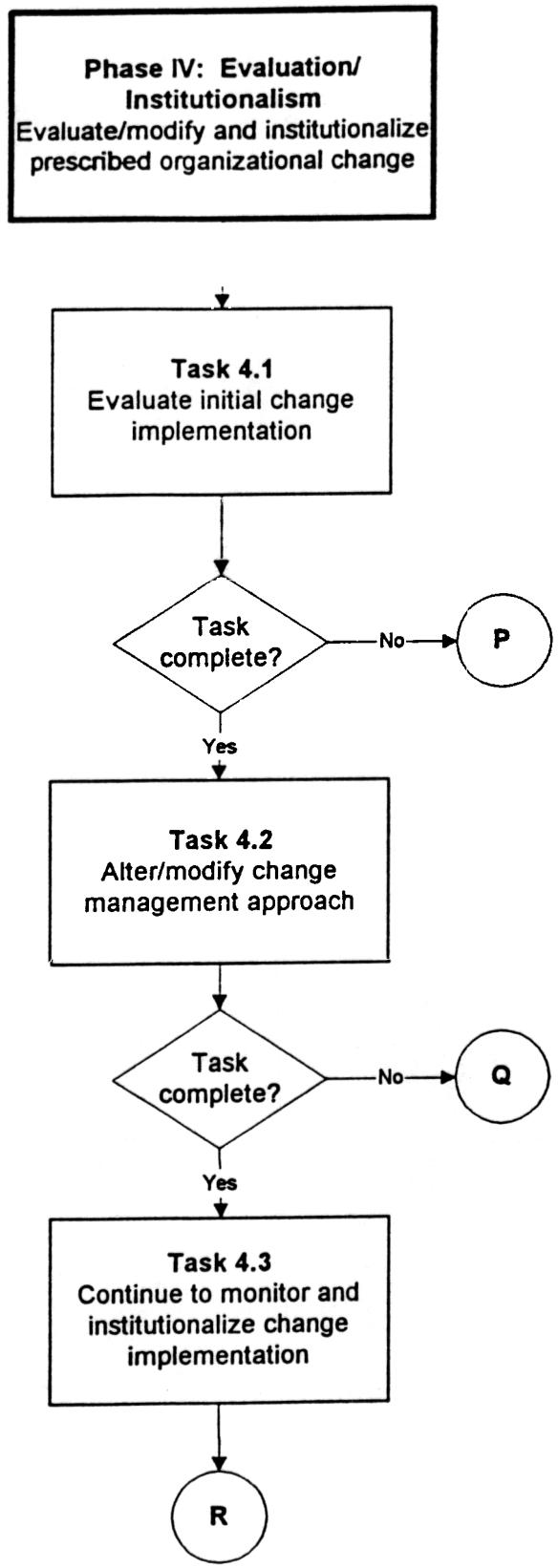
Your input is vitally important. Please return the completed survey in the enclosed postage paid envelope.

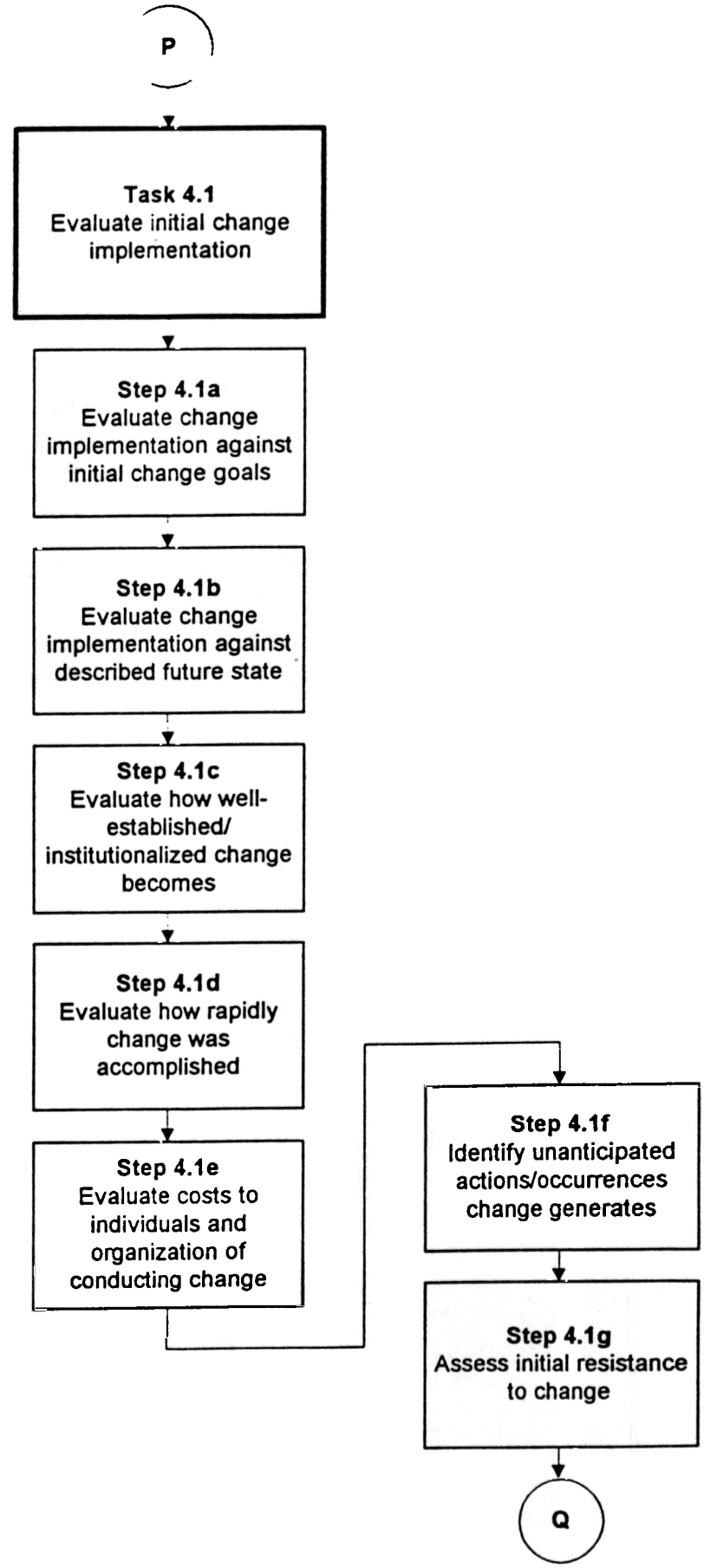
Thank you again for your cooperation and valuable time.

APPENDIX B

THE CHANGE MANAGEMENT MODEL




Phase IV: Evaluation/ Institutionalism
Evaluate/modify and institutionalize prescribed organizational change
Task 4.1
Evaluate initial change implementation
Task complete?
No
P
Yes
Task 4.2
Alter/modify change management approach
Task complete?
No
Q
Yes
Task 4.3
Continue to monitor and institutionalize change implementation
R


P
Task 4.1
Evaluate initial change implementation
Step 4.1a
Evaluate change implementation against initial change goals
Step 4.1b
Evaluate change implementation against described future state
Step 4.1c
Evaluate how well-established/ institutionalized change becomes
Step 4.1d
Evaluate how rapidly change was accomplished
Step 4.1e
Evaluate costs to individuals and organization of conducting change
Step 4.1f
Identify unanticipated actions/occurrences change generates
Step 4.1g
Assess initial resistance to change
Q

APPENDIX C

NUMERICAL SUMMARY

Questions 1 10

1) Our haz-mat team routinely responds to hazardous spills:

[7] strictly within city or municipal boundaries
[1] to specific manufacturing/industrial site(s) only
[19] beyond our city boundary but within metropolitan area
23] within the county
54] to a multi-county or regional response area

2) If service is provided outside your jurisdiction, legal authority is granted through:

[60] mutual aid contracts
[15] other contract language
[23] local, state, or federal code provisions
[11] N/A
5 other . . . .

Inter-governmental agreements
State contract (MN) and a joint powers agreement
MABAS
Regional response team
Through billing the responsible party

3) Our team receives funds from: *(check all that apply)*

[79] taxation
22] special per capita assessment
[54] fee for service
[21] contract fees
[10] other . .

State contracts (3)
Paid industrial team
State grants (2)
Private grants (2)
Hazardous substance fund
Donations (2)
DOD Air Force installation

4) Population served:

[25] less than 50,000
[20] 50,000 to 100,000
[46] 100,000 to 500,000
[15] 500,000 to 1,000,000
[8] over 1,000,000

5) Describe the makeup of your team:

[76] all career
[7] all volunteer
[31] combination

6) How many technicians:

[37] 20 or fewer
51] 21 - 40
[17] 41 - 75
[9] 76 and over

7) Our team is made up of:

[79] fire service personnel only
[0] law enforcement personnel only
[7] combination public safety personnel
[8] private sector/industry based only
[20 combination public safety/private sector

8) All team members come from one organization:

[67] yes
[47] no

9) Our team has been in existence for:

[ ] 0 - 3 years
[57] 4 - 10 years
[46] 11 years and over

10) The team is managed/coordinated by:

81] Fire Chief or designee
5] County Sheriff or other law enforcement designee
21] an appointed board, commission, or individual
4] an elected board, commission, or individual

APPENDIX D

TEAM STRUCTURE COMPONENTS WITH SUCCESS CRITERIA IN INTERVAL SCALES

	Initial change goals	Described future state	How well established	Sense of urgency	Costs to individual & org.	Anticipating the unanticipated	Resistance to change
1) Responds to:							
Municipal	4.38	3.77	3.23	3.50	2.91	3.19	2.75
Industry	4.44	4.52	4.88	4.00	4.00	3.00	1.00
Metro	4.56	4.35	3.91	3.05	3.78	2.89	2.74
County	4.41	4.23	3.53	2.78	3.28	3.09	2.70
Regional	4.57	4.35	3.86	3.12	3.75	3.06	2.50
4) Population served:							
< 50,000	4.36	3.93	3.54	3.12	3.33	2.84	2.68
50 - 100K	4.53	4.28	3.66	2.85	3.26	2.90	2.25
100 - 500K	4.53	4.38	3.77	3.09	3.63	3.04	2.69
500K mil	4.63	4.26	3.95	3.29	4.00	3.57	2.57
mil	4.54	4.31	3.70	3.43	3.33	3.29	2.86
5) Team makeup:							
Career	4.53	4.30	3.79	3.18	3.53	3.08	2.64
Volunteer	4.21	3.73	3.55	3.00	3.14	2.86	2.43
Combination	4.52	4.22	3.59	2.94	3.63	3.03	2.55
6) How many technicians:							
< 20	4.41	4.00	3.48	3.08	3.49	2.74	2.43
21 - 40	4.55	4.28	3.78	3.12	3.49	3.18	2.75
41 - 75	4.54	4.57	3.88	2.81	3.56	3.25	2.44
> 76	4.60	4.43	4.06	3.56	3.89	3.22	2.78

	Initial change goals	Described future state	How well established	Sense of urgency	Cost to individual & org.	Anticipating the unanticipated	Resistance to change
7) Team makeup:							
Fire	4.54	4.38	3.84	3.12	3.62	3.08	2.62
Public safety	4.32	3.70	3.14	3.14	3.57	2.86	3.14
istry	4.51	4.02	3.84	4.17	3.75	2.33	2.00
Public/private	4.42	3.96	3.39	2.70	3.13	3.25	2.55
8) All from one organization:							
Yes	4.54	4.26	3.78	3.20	3.52	2.97	2.47
No	4.46	4.21	3.64	2.96	3.54	3.17	2.79
9) In existence for:							
0 - 3 years	4.47	4.17	3.64	2.60	3.35	3.30	2.90
4 - 10 years	4.47	4.18	3.61	3.18	3.53	3.04	2.66
years and over	4.55	4.33	3.88	3.11	3.58	3.02	2.47
10) Managed by:							
Fire Chief	4.54	4.37	3.81	3.02	.55	3.08	2.55
Sheriff	4.09	3.32	3.17	2.40	2.60	3.00	2.40
Appointed	4.53	4.13	3.57	3.40	3.80	3.00	2.86
Elected	4.17	3.49	3.41	3.25	3.00	3.50	3.00
Arithmetic Mean:							
	4.50	4.24	3.72	3.10	3.53	3.05	2.60
JCHMRT:							
	4.00	3.98	3.00	.00	2.50	4.00	3.00

(STANDARD DEVIATION OF 1.04)

The seven columns represent the seven success criteria in Task 4.1 (Evaluate initial change implementation) of the Change Management Model. A higher number is preferred in columns 1 - 5 (with five being the maximum). A lower number is preferred in columns 6 & 7. The data reflects information obtained from a nine state Midwest survey of level 2 hazardous materials response teams conducted in December of 1997.